Letters to the Editor

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AN IMPROVEMENT IN THE TECHNIQUE OF TIME MEASUREMENT

B. N. BISWAS

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It is needless to reiterate the importance of pulsed sinusoidal oscillations (Biswas *et. al.*, 1966) in the measurement of time interval between two recurrent events (Chance, B., *et al.*, 1949). The common technique utilises passive resistance-capacitance network for shifting the phase of the wave and basically uses this phase-shifted pulsed sinusoid in some way or other for the aforesaid purpose. In such a case the accuracy of the measurement is impared because of the appearance of transients at the output of the passive phase shifter. The technique described here depends on the principle of operation of a Phase Locked Pulsed Oscillator (PLPO) (Biswas *et. al.*, 1967) (fig. 1) which is essentially a

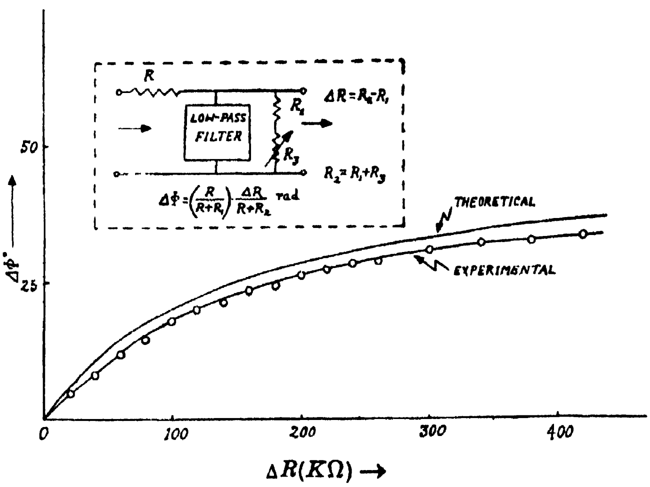

Fig. 1. Typical block diagram of a Phase Locked Pulsed Oscillator.

non-linear feedback control device. It consists of the pulsed oscillator together with a reactance modulator, a phase detector and a low-pass filter network. The use of such a feedback arrangement helps in achieving continuously variable phase-shift of desired amount producing transientless output (waveform) and at the same time maintaining the frequency of the pulsed sinusoid at a constant value.

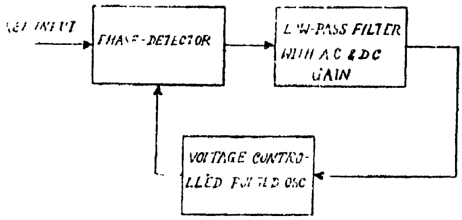

Fig. 2. Graph showing the variation of phase shift of the pulsed sinusoid with the variable load in the filter network.

To understand the mechanism of operation of the PLPO in physical terms (McAleer, 1959), let us assume, to start with, that the frequency of the local pulsed sinusoid is equal to that of the incoming reference oscillation. Then the output of the phase detector, a multiplicative device, is a d.c. voltage that depends upon the static phase difference between the reference oscillation and the local pulsed oscillation during its on-period. This d.c. voltage controls the instantaneous frequency of the local oscillation through the low-pass filter network, in general, having finite d.c. and a.c. gains. Thus any attempted change in the value of the frquency of the pulsed oscillation during its on-period will be first felt by the phase detector as a phase difference and this produces spontaneously a change in the phase detector output d.c. voltage that manages to hold the frequency of the local oscillations to a constant value. It is to be noted that during the off-period of the pulsed oscillations, the local oscillator will have a tendency to fly off from the locked frequency because of the removal of the control voltage at the output of the phase detector. But it has been seen by the authors (Biswas, 1964; Biswas *et. al.*, 1967) that a proper design of the filter network can counterbalance this deletrious tendency of stepping aside of synchronism. Thus the phase transients at the output will also be negligibly small.

With such a system continuously variable phase shift lying between $+90°$ and $-90°$ between the input and output of the PLPO can easily be produced. Theoretical treatment of the subject is not given here for economising the space but the experimentally observed values and the theoretically computed values from our equations have given in fig. 2 for comparison. It is seen that they are in quite good aggrement. It may be noted that the departure between the experimentally observed data and theoretically computed values is due to the mismatch between the variable load, phase detector and the reactance modulator. This can be eliminated by introducing proper balancing arrangement in the system. If one is interested in the phase following behaviour and noise squelching properties then it is suggested that a proper design of the filter network and an appropriate choice of the gain parameter of the system can serve that desired purpose (Biswas, 1966).

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SPACE GROUP OF O-BENZOYL BENZOIC ACID

M. L. KUNDU AND S. C. CHAKRAVORTY

Department of Physics Burdwan University, Burdwan, West Bengal, India

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The crystals of o-benzoyl benzoic acid, (chemical formula $C_6H_5COC_6H_4COOH$ and m.p. 127°C), obtained from its saturated solution both in absolute alcohol and benzene by slow evaporation, are transparent prismatic needles. Crystals from alcohol show, in general, eight faces about the needle axis, but those from benzene show six faces. The preliminary optical study of a crystal was carried out with an optical goniometer and since all the faces did not give prominent reflections, interfacial angles could only be measured approximately.

The axial lengths, $a = 7.71$ Å, $b = 8.28$ Å and $c = 9.95$Å were determined from the rotation photographs about the proposed [100]-, [010]- and [001]- axes. The zero-level normal beam weissenberg photographs were also taken about these three axes. From the symmetry of the weissenberg photographs and other considerations it was confirmed that the crystal belongs to the triclinic system. The positive directions of a, b and c axes with the condition $a < b < c$, were chosen according to the standard practice in right handed system.

The angles between the faces (100), (010) and (001), obtained from the zero-level weissenberg photographs, are

$$\alpha^* = 76°, \quad \beta^* = 96° \quad \text{and} \quad \gamma^* = 92°30'$$

The values of the axial angles, calculated directly from these values with the help of standard formulae, are

$$\alpha = 103°50', \quad \beta = 84°26' \quad \text{and} \quad \gamma = 88°56'$$